A World Wide Web Human Dimensions Framework and Database for Wildlife and Forest Planning

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Abstract: The paper describes a human dimensions framework (HDF) for application in wildlife and forest planning. The HDF is delivered via the world wide web and retrieves data on-line from the Social, Economic, Environmental, Leisure, and Attitudes (SEELA) database. The proposed HDF is guided by ten fundamental HD principles, and is applied to wildlife and forest planning using eight social assessment questions that cover a broad spectrum of primary social information in wildlife and forest decisions. Five dimensions of social information were identified (historical background, population characteristics, community resources, social organization and processes, and public perceptions and well-being) and tied to one or more of the social assessment questions. In turn, each dimension was comprised of multiple concepts and indicators. The HDF website uses the SEELA database to provide users with immediate on-line access to over 300 variables that cover two primary dimensions: population characteristics and community resources. For the remaining three dimensions, the website provides guidance to methods of collecting data on relevant variables. The website is illustrated using examples in wildlife, and implications for wildlife management and distance-based training are discussed.

Keywords: Human dimensions, framework, wildlife, forest planning, World Wide Web

Introduction

This paper demonstrates the application of a human dimensions framework (HDF) and database for wildlife and forest planning using the World Wide Web as a delivery mechanism. The first part of the document describes the HDF (including principles and conceptual elements of the

framework) using the general context of forest planning (specifically, the social assessment component of forest plans). The second part of the document illustrates web-based delivery of the HDF and database using wildlife examples and describes implications of the HDF and website for wildlife management.

Background

The use of "human dimensions" (HD) information in forestry and wildlife is not entirely new (Manfredo, Vaske, & Sikorowski, 1996). Activities such as managers' personal encounters with visitors, public meetings and open houses, and the distribution of information in the form of pamphlets and brochures all fall under the rubric of human dimensions. Unfortunately, the connection between human dimensions and forest and wildlife decisions has generally focused on "common sense," which is considered too inexact to be addressed as part of scientific management. There is, however, a growing emphasis on the science and application of HD, which involves integrating information obtained from the social sciences into the decision-making process on an equal footing with information from the biological and physical sciences (Driver, Manning, & Peterson, 1996; Machlis, Force, & Burch, 1997).

HD inquiry may be defined as "the scientific investigation of the physical, biological, sociological, psychological, cultural, and economic aspects of natural resource utilization at the individual and community levels" (Ewert, 1996, p. 6). Information about HD recognizes that people are part of ecosystems whose needs, perceptions, beliefs, values, and behaviors have important influences on forest ecosystems. Such information includes (a) the interaction of social and cultural units of organization with natural resources, (b) demographic trends within a given geographic region, (c) the nature of economic structures and market forces and their role in forest management, (d) the nature of local, state, and federal political institutions within the region, and (e) the social-psychological dynamics of the citizenry, including attitudes, beliefs, motivations, and values (Ewert, 1996; Manley et al., 1995).

Traditionally, managers have linked the HD of wildlife and forest management to the identification of commodity values, such as the value for timber, wildlife-dependent recreation (e.g., hunting and fishing licenses), range, and minerals. These values, with their role in market exchanges, are relatively easily measured using monetary units. Increasingly, however, the public is placing importance on social values that are not so easily measured, including amenity values (e.g., wildlife diversity, scenery, and nature), environmental quality values (i.e., air and water quality), ecological values (e.g., habitat conservation, sustainability, threatened and endangered species,

and biodiversity), public use values (e.g., subsistence and tourism), and spiritual values. This shift in public thinking has been reflected in the passage of several pieces of legislation over the past four decades that have (a) expanded the view of forest management beyond commodity-based practices to a recognition of a broader set of human values related to specific resources (e.g., Wilderness Act 1964, Wild and Scenic Rivers Act 1968, Endangered Species Act 1973), (b) directly considered human welfare in the condition of the overall natural environment (e.g., Clean Air and Clean Water Acts and subsequent amendments), and (c) encouraged and, in some cases, required the incorporation of public involvement in the planning process (e.g., National Environmental Policy Act 1969, National Forest Management Act 1976).

Increased public attention to wildlife and forest management has resulted in a growing reluctance to accept decisions based primarily on scientific evidence or with very little recognition of social values. Although agency scientists and managers understand how to grow trees, manage fish and wildlife populations, fight forest fires, and stabilize watersheds, they have less experience in, and knowledge of, managing for the increasingly important diversity of social values (Manley et al., 1995). The growing number of lawsuits across the country that address natural resource management practices speaks to the willingness of the public to challenge the "manager as expert" paradigm that traditionally drove the policy making of land management agencies (Schlager & Freimund, 1997). In sum, as the perception of a human–natural environment dependency becomes re-established in today's society, the trend is toward recognizing the importance of social, physical, and biological information in effective wildlife and forest management.

Guiding Principles for a Human Dimensions Framework

Social information within a human dimensions framework (HDF) may be the driving force behind the concept of "collaborative stewardship" (Driver et al., 1996). It allows for a broad range of potential stakeholders, with differing values and cultural identities, to have a voice in planning decisions. If properly conducted, the use of HD information allows for the evaluation of not only how people affect resources but also how resource management affects people. For an HDF to respond to the social assessment needs in forest planning, it should be guided by fundamental principles that provide consistency across all geographic scales of analysis (e.g., from local to landscape). The following set of principles, which provide the basis for our HDF, was derived from a workshop held in Salt Lake City, Utah, in 1997. This workshop involved social scientists from a variety of academic disciplines (representing social psychology, environmental psychology, rural sociology, resource economics, ecology, anthropology, political sci-

ence, archaeology, geographic information systems, social ecology, history, and landscape architecture), research social scientists within the USDA Forest Service, and Regional Forest and State and Private Forestry specialists to discuss social science applications and to identify some fundamental principles of HD. Our principles also build on previous efforts, such as the USDA Forest Service National Task Force on the Human Dimensions of Ecosystem Management (1994) report.

Principles 1–4 address the basic nature of social science information in forest planning. Principles 5–7 address the importance of incorporating many social science disciplines and the nature of social assessment indicators. Principles 8–10 address the extent to which an HDF can provide the organization of social information with the methods necessary for gathering and integrating information.

Principle 1. A prerequisite for integrating HD with biophysical information in forest planning is a thorough understanding of the social environment of the affected region. Information collected from HD research includes a variety of interrelated data. This includes information about the social and cultural diversity of a region, demographics, economic structures and market forces, technology, political institutions, and held values (including knowledge, attitudes, and beliefs) and behaviors of stakeholders and other interested publics.

Principle 2. Social information should be representative of the broadest possible number of constituencies with an interest or stake in the region of interest. This principle involves ensuring that all sectors of the public are recognized as to their stakeholder status (past, current, and future) and recognizing that the stakeholders with interests in the management of a specific area are not limited solely to those people who live in the local community or region. Many different perceptions of acceptable forest and wildlife decisions and actions exist, along with an increasing diversity of stakeholders with an interest in how natural resources are managed.

Principle 3. Social information collected related to forest management should be driven by specific planning issues. Not all types of social information are relevant to every policy issue. Ensuring that social information is a useful tool for wildlife and forest management requires beginning with the problem or policy issue. Ideally, stakeholders should be included at the beginning of the process to collaboratively identify the important problems and policy issues, viewing identification of issues as a "bottom-up process." It is important to remember that social science information is not decision making, rather it is input into decision making.

Principle 4. Social information should provide an historical and current description of the social environment with an eye on future trends. The social, demographic, and economic makeup of a geographic region as well as

attitudes and values held by stakeholders within the region is not temporally stable, i.e., these may change over time. An historical analysis of the social environment provides clues on what has happened before that has led to the current environment. In turn, an historical analysis may also provide clues regarding what the important issues of the future are.

Principle 5. Information from different social science disciplines should be integrated to contribute to an assessment of the social environment. To understand the HD of wildlife and forest management, knowledge from a variety of social science disciplines should be integrated so that the social context of human interactions with the forest is understood. Current HD information includes the work of social scientists from a variety of disciplines, including social psychology, sociology, economics, anthropology, archaeology, political science, geography, ecology, history, and landscape architecture, among others.

Principle 6. Social information should be gathered and synthesized using a variety of data sources, types, and methods of collection. An effective synthesis of social information from various social science disciplines requires recognition that not all sociocultural information is expressed in documents and databases. Therefore, a variety of sources of information should ultimately be explored, including the use of both secondary and primary data. In addition, it should also be recognized that both quantitative and qualitative data are relevant to addressing HD issues. For example, quantitative indicators may not provide adequate information about the political climate surrounding an issue, including a critical assessment of relevant agencies and interest groups; qualitative data are also necessary for a comprehensive analysis of the political environment. The same need for both quantitative and qualitative data exists for other aspects of the social environment. Finally, social information should reflect a merger of new data collection methods with existing successful methods. One way of doing this is to formally catalogue successful case studies that have already been done and develop a system for planners and managers to access those examples. Adhering to the various sources, types, and methods of data collection will contribute to the ability to "tell a story" about the historical and current social contexts in which wildlife and forest management policies are being considered.

Principle 7. Social information should demonstrate a connection between theory-based research and practical managerial applications. A problem that is often cited is the chasm that sometimes exists between theoretical research conducted by scientists and the need to actually use the information by on-site managers and planners. Appropriate use of social information recognizes the need to provide practical human dimensions information that on-site managers and planners can use in order to make better decisions.

Principle 8. An HDF should guide the collection of social information for multiple scales of analysis. Biophysical scientists have identified a mappable hierarchical classification of ecological units for the purpose of facilitating study of the biological and physical aspects of forest management. Such units are designed to feature similar patterns in physical features including soils, landform and topography, climate, and other natural processes. Because wildlife and forest management concerns exist at multiple spatial scales, from landscape to community, a similar hierarchy is relevant for the assessment of social conditions. An HDF should provide guidance on assessing the social environment surrounding a particular issue for all relevant spatial scales.

Principle 9. An HDF should connect specific social concepts, and relevant indicators, to agreed on principles and guidelines. The existence of basic principles and guidelines provides continuity across regions and time and contributes to the generalizable nature of data obtained in individual assessments. For concepts and their indicators to be relevant, they should (a) reflect a system of principles and guidelines generally agreed on by all potential users of the indicators, and (b) focus on stated goals, strategic priorities, and desired outcomes; that is, focus on real-world issues while being conceptually grounded.

Principle 10. An HDF should show clearly the relationships among resource issues, social assessment questions, and social science concepts and indicators. Planning should begin with the definition of the important issues to be addressed. Furthermore, specific questions should be asked that address the important components of the management issues. To be most applicable to forest planning, an HDF should clearly show the connection between general and specific aspects of management issues.

Application of a Human Dimensions Framework to Forest Planning and Social Assessments

A broadly accepted set of guidelines and procedures within a conceptual framework has not been developed and extensively applied to forest planning (Bright et al., in press). The type of information in the social assessment portion of a forest plan includes trends in population and other demographics; resource use; recreation use; location of different cultures; amount of community cohesion (unity and cooperation); regulatory and societal norms of behavior of a community; public opinion regarding key issues; existence and nature of stakeholder groups; opinion leaders within a community; and key economic indicators representing economic and industrial diversity of the region, employment rates and types, and income levels. A basic role of social assessment is to provide baseline information about the social environment of a region so planners may relate the social

environment to specific management issues (Stewart, Jakes, & Monson, 1997). Unfortunately, in most instances the hierarchical geographic scale for conducting social assessments is different than that represented by ecological units. Driver and colleagues (1996) suggested the following levels of scale for social analysis: small/local (i.e., site, project, and local community), medium/multi community (i.e., medium-size natural ecosystem such as a national forest), large/regional (i.e., large size natural ecosystem such as all or parts of several national forests), and very large/national (several regions that may cross political boundaries to include international and global concerns).

The Human Dimensions Framework Described

The HDF is a question-based tool that connects social assessment questions, social information designed to answer the questions, and appropriate methods of collecting data about the social information. In the HDF, eight social assessment questions were developed to address some of the primary social information related to forestry and wildlife (Table 1).

Table 1
Social Assessment Questions
for the Human Dimensions Framework

A. What are the human uses of the assessment area?
B. Who are users of the assessment area?
C. What are the social and economic characteristics of the surrounding geographic region?
D. What conflicts exist among various uses, users, and managers of the ecosystem?
E. What is the nature of the relationships among the community, the forest, and the larger ecosystem?
F. What are stakeholder and public perceptions related to ecosystem management issues?
G. What values do stakeholders and the public hold related to the environment, the surrounding natural resources, and the uses of those resources?
H. What social and economic trends are occurring in the region relevant to the management of the ecosystem?

Five dimensions of social information were identified that cover the types of information that a social assessment should address. In turn, several specific concepts are related to each dimension, as well as multiple indicators designed to measure each concept. Social indicators are measures of social dimensions (Force & Machlis, 1997) and are comprised of one or

more variables. Each social indicator, and ultimately each variable, is connected to one or more of the eight specific social assessment questions. Table 2 illustrates the relationship among the indicators, concepts, dimensions, and assessment questions used in our framework. The dimensions, concepts, and indicators were identified and developed with the assistance of representatives at the 1997 Utah workshop. (See Branch, Hooper, Thompson, and Creighton, 1984, for further discussion of social dimensions and concepts in natural resource management.)

Table 2
Relationship of Dimensions, Concepts, Indicators, and Assessment Questions in the Human Dimensions Framework

Dimensions, Concepts and Indicators[a]	A	B	C	D	E	F	G	H
1. Historical Background[b]								
Community origin	•			•	•			•
Recent experience with ecosystem management issues	•			•	•		•	•
Characteristics of influential people, groups, or families	•		•					
Community characteristics that are valued locally			•			•		
Prominent stakeholder groups with a history in the area	•		•	•				
2. Population Characteristics								
2a. Cultural Characteristics								
Ethnicity/race		•	•	•				•
Language diversity			•	•				•
Religious affiliations and practices	•	•	•	•				•
Property ownership	•	•	•	•				•
Length of residence			•					•
Cultural-based values			•	•	•	•	•	•
2b. Population and Demographics								
Total population			•					•
Changes in population size			•					•
Residential distribution	•	•	•	•				•
Age distribution			•					•
Gender distribution			•					•
Education			•					•
Dimensions, Concepts, and Indicators[a]								
Household composition			•					•
Population and demographics by ethnicity	•	•						•
2c. Economic and Employment Characteristics								
Employment levels			•					•
Occupational diversity	•	•	•			•		•
Distribution of employment by sector	•	•	•			•		•
Labor force participation by groups	•	•	•			•		•
Household income			•					•
Poverty			•					•
Wealth			•					•
Public assistance and welfare			•					•

Dimensions, Concepts, and Indicators[a]	A	B	C	D	E	F	G	H
Economic and employment characteristics by ethnicity			•				•	
3. Community Resources								
3a. Facilities and Services								
Current levels of public facilities and service			•		•			
Current levels of private facilities and service			•		•			
3b. Spatial Relationships and Ecosystem Dependency								
Ecosystem classifications				•	•			
Water resources				•	•			
Energy and mineral resources				•	•			
Wildlife abundance				•	•			
Recreation resources				•	•			
Public land classifications				•	•			
Private land classifications				•	•			
Dimensions, Concepts, and Indicators[a]								
Resource uses				•	•			
Population density				•	•			
In- and out-migration				•	•			
Settlement patterns				•	•			
Land tenure				•	•			
Social Organization Structures and Processes								
4a. Economic Organization								
Economic diversity	•	•	•	•	•			•
Export dependency			•					•
Small businesses			•					•
Shopping patterns			•					•
House values			•					•
Land values			•					•
Retail sales expenditures			•					•
4b. Government Structure								
Local government positions				•				
Formalization of planning department				•				
Connections to outside agencies				•				
Relationships between local government jurisdictions				•				
4c. Social Diversity								
Gender distribution			•				•	
Ethnic and religious/cultural diversity			•	•			•	
Residential stability			•	•			•	
Voluntary organizations and membership	•	•	•				•	
Factions and special interests	•	•	•				•	
Values and beliefs related to natural resources				•			•	
Attitudes toward natural resource issues				•			•	
Transient populations			•				•	
Civil rights			•				•	
4d. Outside Linkages								
Local ties to state and federal governments				•	•			

Dimensions, Concepts, and Indicators[a]	A	B	C	D	E	F	G	H
Previous federal/state grants and other programs				•	•			
Businesses/agencies in the area				•	•			
Proportion of local residents who are new to the area				•				
4e. Distribution of Resources and Power								
Equity				•				
Environmental justice	•			•	•			
Size and structure of local government				•				
Presence of stakeholder groups	•	•		•				•
Norms				•				
4f. Community Resilience								
Coordination in recently initiated projects				•				
Existing coordination mechanisms				•				
Persistent conflicts or issues				•				
5. Public Perceptions and Well-Being				•				
5a. Perceptions of Natural Resources								
Values and beliefs related to natural resources				•	•	•	•	
Attitudes toward natural resource issues				•	•	•	•	
Values and beliefs supported by stakeholder groups				•	•	•	•	
Attitudes supported by stakeholder groups				•	•	•	•	
5b. Connection to Natural Resources								
Importance to recreation and tourism	•			•	•		•	•
Importance to livelihood	•			•	•		•	•
Importance to customs and traditions	•			•	•		•	•
Sense of place	•			•	•		•	•
5c. Perception of Well-Being								
Behavioral and situational conditions			•				•	•
Perceived access to facilities, services, and resources		•					•	•
Community satisfaction		•					•	•

[a] Dimensions are listed numerically (e.g., 1,2, 3, etc.); concepts are listed numerically and alphabetically (e.g., 2a, 2b, etc.), indicators are listed under each concept.
[b] Dimension 1, historical background, has only one related concept.

Dimensions and Concepts of Social Information. Social dimensions represent key components of, and relationships within, the human ecosystem that affect or are affected by the ecological system. As such, they are an amalgamation of concepts representing key components of human ecological system relationships from a variety of social disciplinary perspectives. The five dimensions included in this HDF are: historical background, population characteristics, community resources, social organization structures and processes, and public perceptions and well-being.

The *historical evolution* of a community is important because it aids planners in identifying the source of social attitudes and the social structure of the community. It includes, for example, community origin, important past events influencing natural resource decisions, and recurring problems found in the community.

The most basic dimension of a social assessment is a description of the *characteristics of the population* of interest, including (a) demographics, (b) cultural characteristics, and (c) economic and employment characteristics. Demographics provide a description of the general nature of the community such as changes in population size, household composition, residential distribution, and so on. A detailed analysis of the cultural characteristics of a community or region is especially warranted if the study area includes diverse racial, ethnic, religious, or occupation-based populations, as such groups are likely to hold different values regarding forest and wildlife management issues. Economic and employment information concerns the extent to which a local economy either depends on, or is moving away from, a forest-based economy, as indicated by occupational diversity, employment levels by sector, industrial diversity, and so on.

Community resources represent the nature of resources in and around the community and may be assessed using two basic concepts: (a) facilities and services, and (b) spatial relationships and dependency. Changes in population, economic activity, and income can directly influence the supply of facilities and services, and the cost, quality, and availability of such services are connected to the public's perception of community health and well-being. Indicators of facilities and services include public institutions (schools, health care, social services, etc.), private services (e.g., housing, medical care, and household services), and level of access. Spatial relationships and dependency refer to people's dependence on and use of ecological resources. Understanding the type and extent of these relationships provides planners with important information to manage for sustainable ecosystems, including identifying and promoting alternative economic activities on forests, employment retraining, and community education. Indicators include the amount and type of resources and use (water, wildlife, forestry, recreation), ecosystem classifications, and settlement patterns.

The fourth dimension, *social organization and processes,* is the social, interactive nature of a community or region. Such interactions have generally evolved over time and are unique to each area. The major components include (a) economic diversity and complexity (e.g., industrial opportunities, multiplier effects), (b) governmental diversity (e.g., size of local government, type and extent of community planning administration), (c) social diversity and complexity (changes in demographic diversity, migration rates, presence of special interest groups), (d) outside linkages

(i.e., the extent to which decisions about investment opportunities, resource distribution, etc. are made by interests outside or within the local community or region), (e) resource distribution and power (i.e., the type and extent of resources across various stakeholders), and (f) community resilience (i.e., the ability of a community to adapt and control change see also Machlis et al., 1997).

The fifth dimension, *public perceptions and well-being,* examines public attitudes toward (a) wildlife and forest management issues and practices, (b) general human–environment relationships, and (c) quality of life. First, many people with an interest or stake in the management of local wildlife and forest resources are not part of a vocal minority; therefore, efforts should be made to obtain information about public perceptions regarding relevant issues that are representative of all publics in an area. Planners should decide the weight that perceptions of specific groups or influential individuals should be given. Second, general human–environment relationships represent the personal meaning (i.e., "sense of place") of the natural resources to individuals and to the community. Such meaning can be found in the outdoor activities that take place in the region, the resources as a source of income, and the extent to which the resources support community and family traditions. Third, quality of life issues concern perceptions that residents have about their community, as indicated by crime, divorce, and unemployment rates; access to facilities, services, and resources; and levels of community satisfaction.

Because social life is multidimensional, it is important to recognize that the five dimensions are not independent of one another. For example, community resources (in terms of social, economic, and cultural conditions) are dependent on the influential decision makers in the community, including stakeholders, special interest groups, public authorities, and so on, (social organization structure and processes), as well as by population demographics. Because of the dependency among the five dimensions, multiple dimensions will be used to examine any single social assessment question.

Web-Based Delivery of the Human Dimensions Framework

A World Wide Web site (http://hdf.itos.uga.edu/) has been developed that applies the HDF to wildlife and forest planning (Figure 1). The site provides immediate on-line retrieval of a limited amount of secondary data through guided access to the Social, Economic, Environmental, Leisure, and Attitudes (SEELA) data set and will be demonstrated here using examples in wildlife. SEELA is a collection of social information at the county level for all counties[1] of the United States compiled from the following sources: National Outdoor Recreation Supply Information System (USDA Forest Service, 1997), Social Geographic Information System (USDA Forest Service, 1996), USA Counties Bureau of the Census CD

(U.S. Department of Commerce, 1996), and The Complete Economic and Demographic Data Source (Woods & Poole Economics, Inc., 1997). Access to the SEELA data set is guided by the eight social assessment questions of the HDF. Although over 300 variables are included in the SEELA data set, many of the social indicators that describe the three dimensions of historical background, social organization and processes, and public perceptions and well-being are not adequately represented in SEELA. Where social variables and indicators are not available via SEELA, the web-site describes appropriate methods for collecting data. SEELA, however, does provide very good coverage and time-series information (in some cases from 1970 to 1996) for two of the dimensions: population characteristics and community resources. Data retrieved from SEELA are output via the WWW using geographic information system (GIS) generated maps as well as in table and chart form.

Steps in the Human Dimensions Framework Website. The HDF website is organized using a seven-step process. Step 1 prompts users to select one of the eight social assessment questions. Tied to each assessment question are relevant dimensions, concepts, indicators, and variables as determined by the HDF. For each dimension selected (step 2), a complete description of that dimension and relevant concepts is provided along with the respective indicators. For each indicator selected (step 3), the website provides either direct access to variables in the SEELA data set or, if SEELA does not contain social information corresponding to the selected indicator(s), provides a description of the method commonly used to gather data about the indicator(s) appropriate for the population of study. For example, "community origin" is an indicator of the "historical background" dimension and concerns variables related to the historical evolution of the community, including key industries, nationalities, social attitudes, and behaviors that have evolved over time. As there are no variables in SEELA that correspond to community origin, the website user is provided a detailed description (and step-by-step procedure) of the appropriate methods for collecting information pertaining to the indicator(s) (e.g., historical and archival analysis). For indicators included in SEELA, users are provided a list of relevant variables and asked to select one (step 4, Figure 2). For example, under assessment question E, "What is the nature of the relationships among the community, the forest, and the larger ecosystem?" the dimension of "community resources" is applicable. Under community resources, a list of 130 variables available in SEELA (ranging from climate conditions to ecosystem classifications and acres managed for recreation and wildlife) is provided, of which users select one (e.g., state wildlife land acres). See Table 3 for a complete list of variables in SEELA that are especially relevant to wildlife.

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[1] As a basic subdivision of states, counties are a major unit of analysis for census geography (Force & Machlis, 1997; Myers, 1992). The county is also the smallest scale for which most secondary data (at the national level) are collected and available.

Figure 1
World-Wide-Web Home Page for the
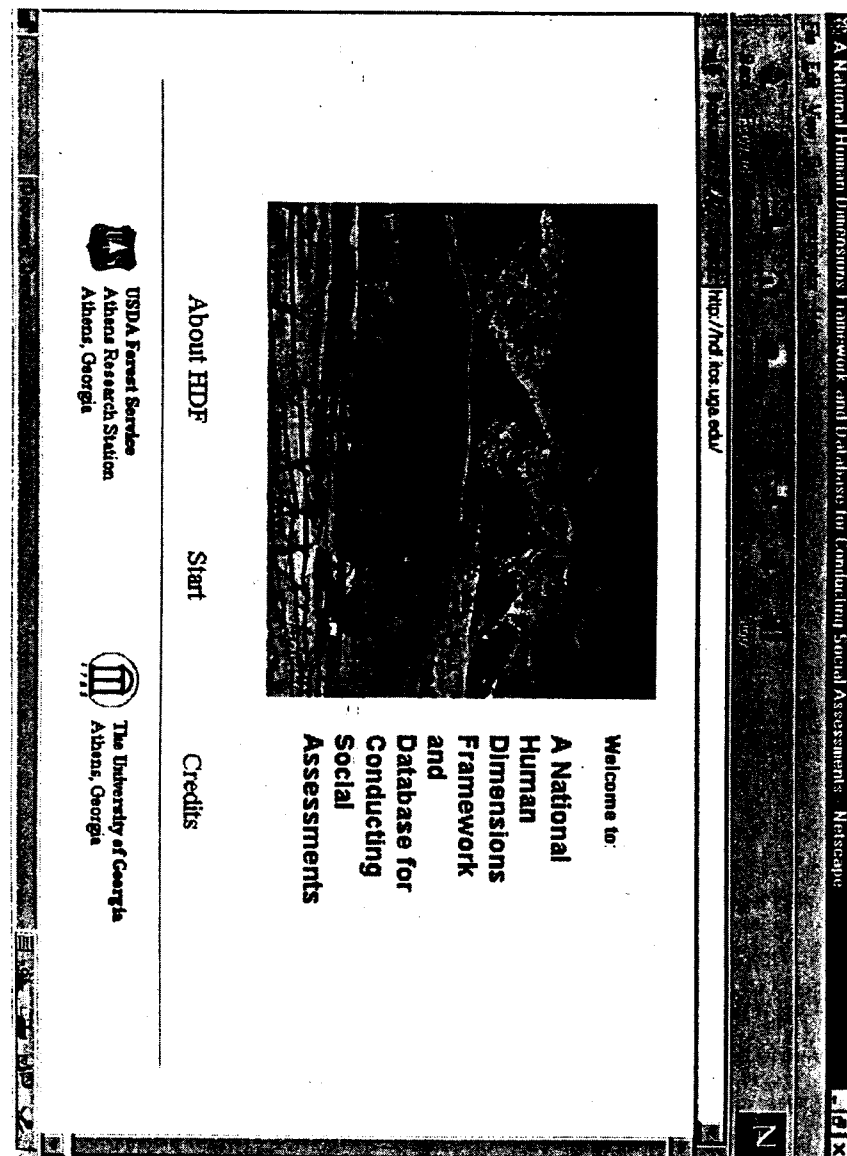**Human Dimensions Framework Web-site**

Figure 2
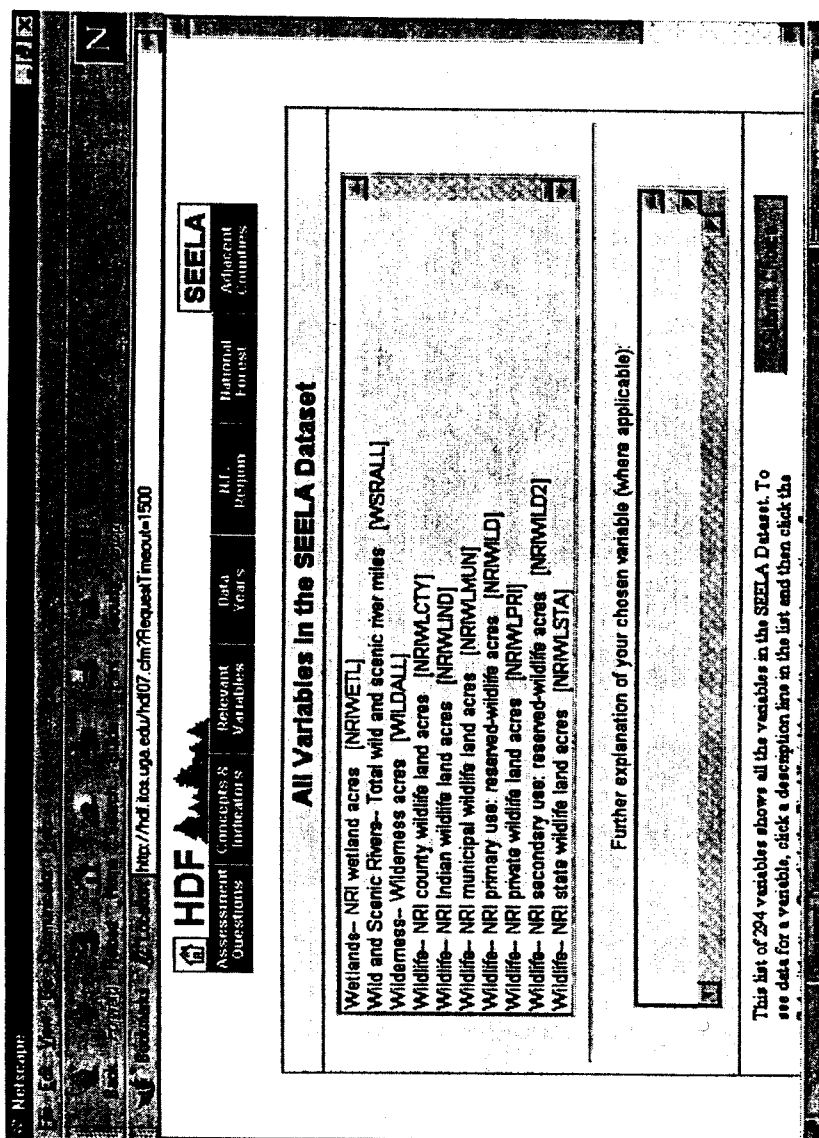## Example of Relevant Variables in the SEELA Database for the "Community Resources" Dimension

Table 3
Wildlife-Related Variables in the SEELA Database

Variable (at County Scale)	Year(s)
All value-added (fisheries sector)[a]	1977, 1982, 1985, 1990, 1991, 1992, 1993
Bailey's ecosystem classifications	1996
Exotic bird species[b]	1992
FWS refuge acres open for recreation[c]	1992
FWS wetland management district acres	1992
Habitat disturbance[d]	1992
Native breeding bird species richness [e]	1992
NRI crop acres of permanent wildlife habitat[f]	1992
NRI primary use as reserved-wildlife	1992
NRI secondary use as reserved-wildlife	1992
NRI acres wildlife land by administrative unit	1992
County	
Native American Indian	
Municipal	
Private	
State	
Threatened and Endangered Species (animals)[g]	1992

[a]Derived from the sum of employee compensation, indirect business taxes, and proprietor income.

[b]Proportion of birds that were exotics. Data were collected along individual BBS (North American Breeding Bird Survey) routes.

[c]FWS (Fish and Wildlife Service).

[d]Ratio of relatively undisturbed land uses and cover (forest, range, wetlands) to total acres in the county.

[e]Average number of native breeding bird species per year reported.

[f]NRI (Natural Resources Inventory).

[g]Number of T&E animal species by county and standardized by total county area (acres).

Once a single variable in SEELA has been identified, step 5 prompts users to select a geographic region of interest (Figure 3) and specific national forest (Figure 4). By default, all counties within or adjacent to the selected national forest are selected. For example, 22 counties in Colorado and Wyoming are either within or adjacent to the Roosevelt National Forest. Users can select a single county, multiple counties, or all counties (Figure 5). Data for selected counties are displayed first in table and chart form (step 6) and then as a GIS map (step 7). Tabular data are expressed in both absolute and relative percentage values. Charts are displayed as either pies or bars (Figure 6). GIS maps are generated either with or without county names and display data as shaded counties using quartile (four-class) ranges (Figure 7).

Figure 3
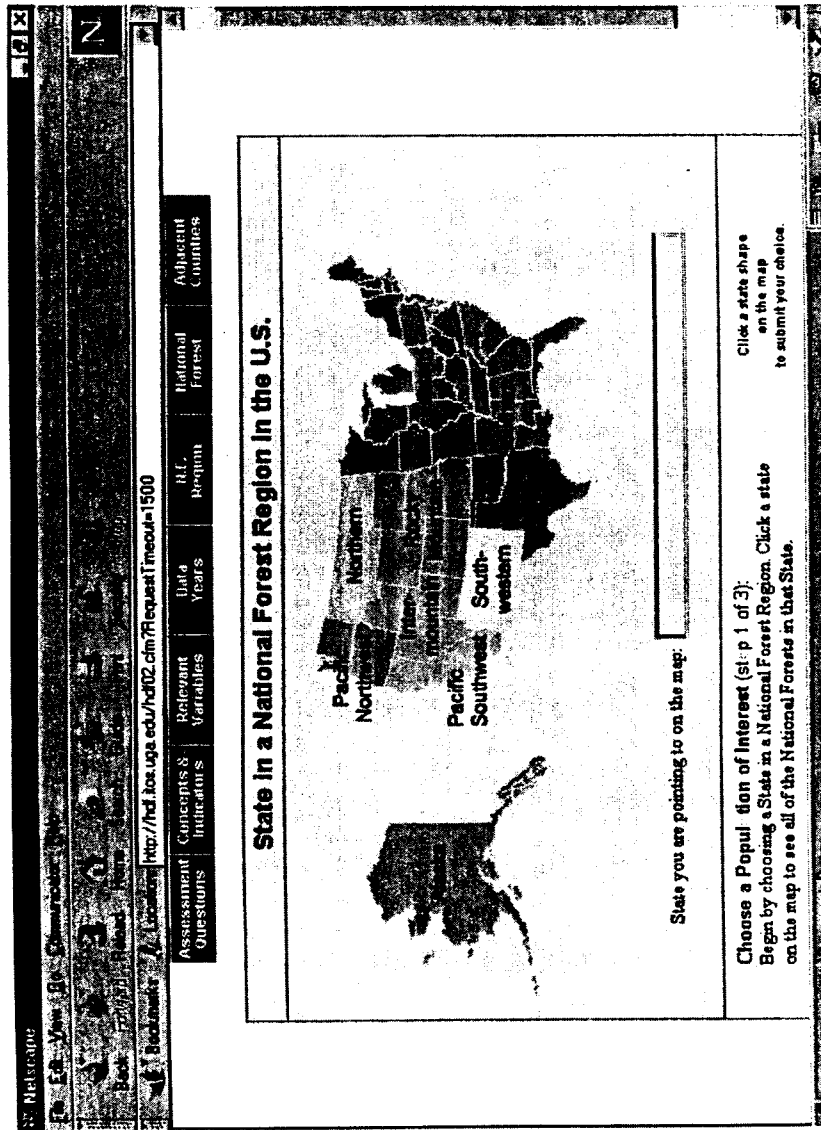**Selecting a Geographic Region of Interest**

Figure 4
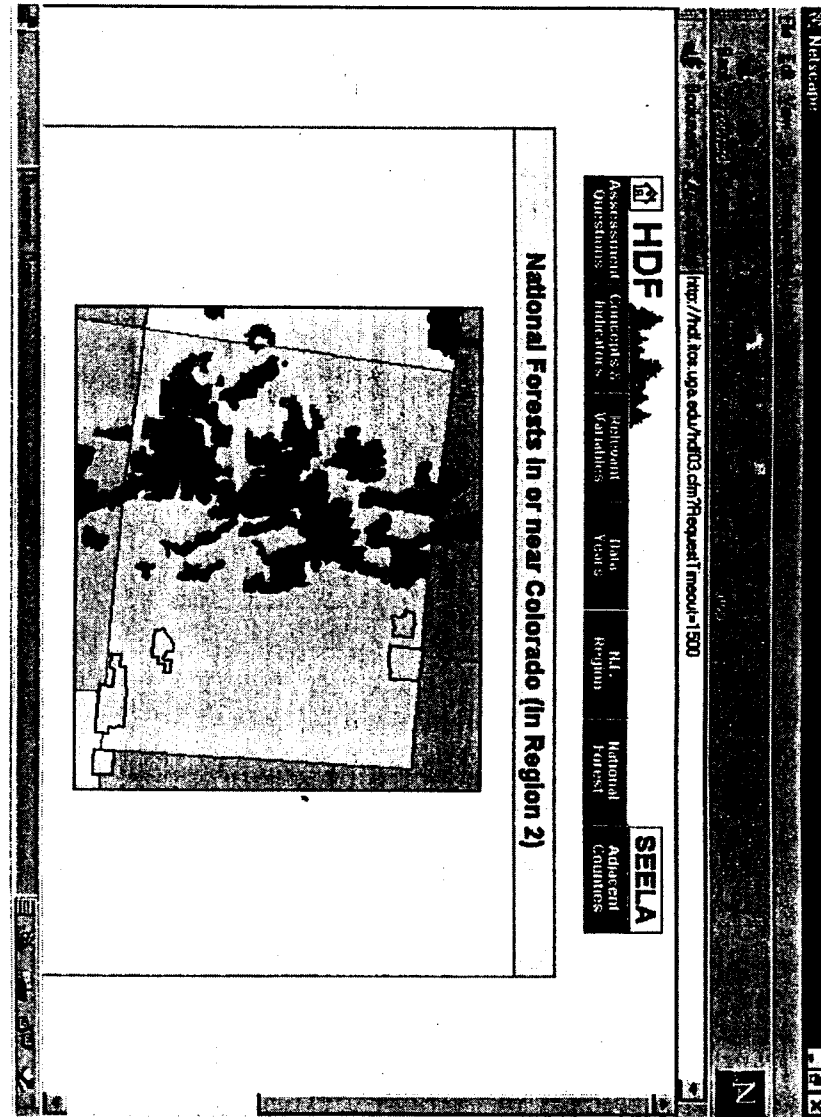**Selecting a National Forest of Interest**

Figure 5
Selecting County(ies) of Interest
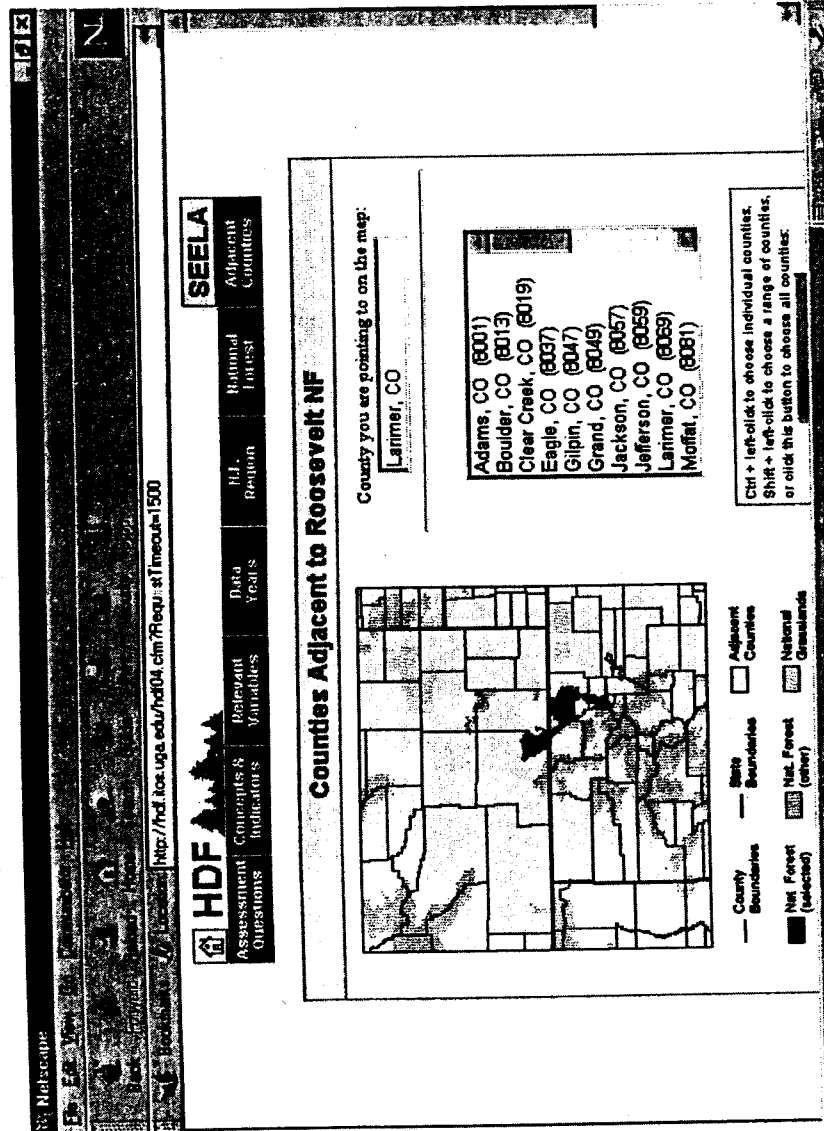

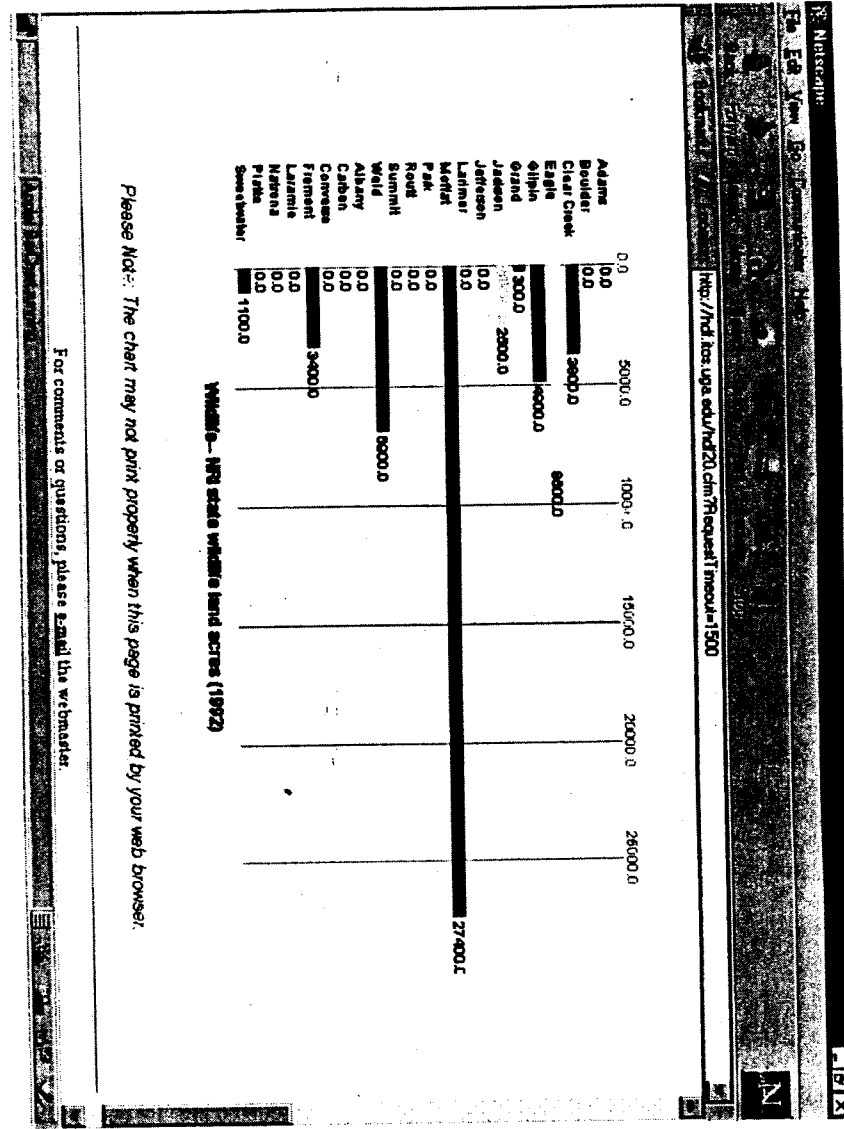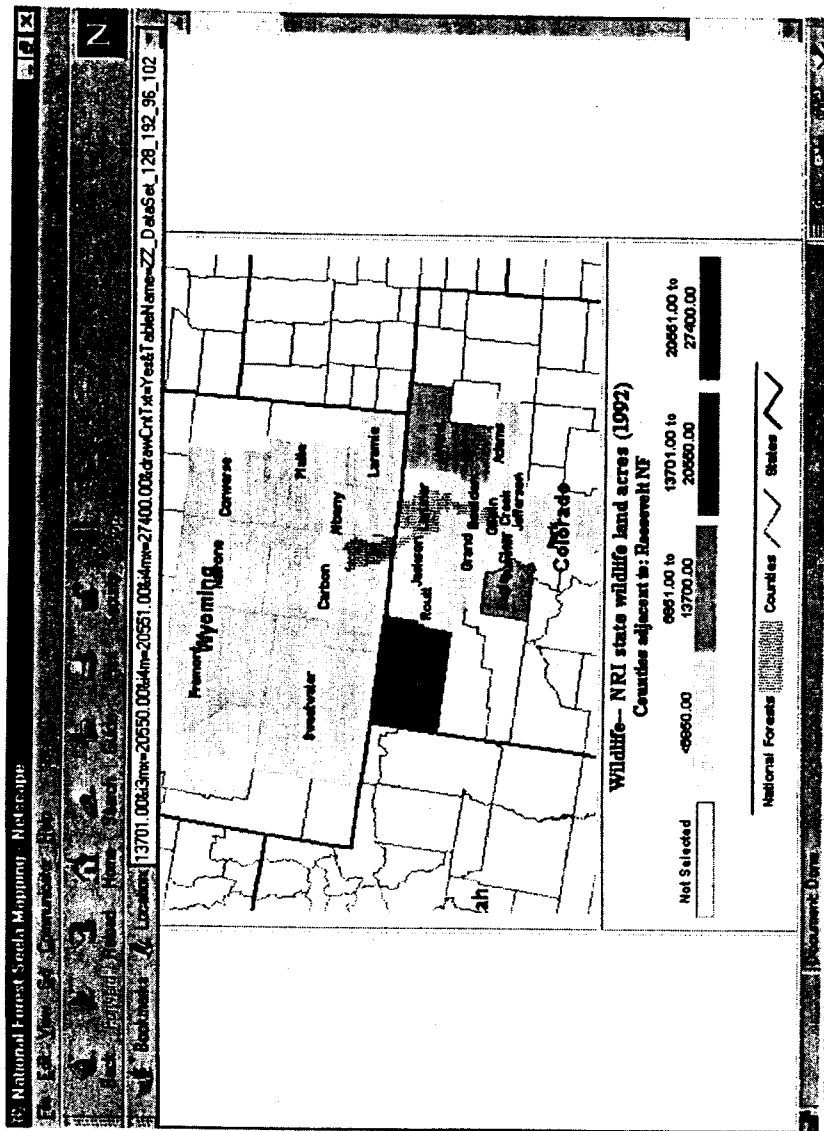**Figure 6**
Data Output in Bar-Chart Form

Figure 7
Data Output in GIS Map Form

System Development of the Human Dimensions Framework Website. A Sequel database contains the SEELA database (comprised of 294 variables at the county scale) oriented by the HDF (consisting of a hierarchy of the eight assessment questions, five dimensions, and social indicators). The interface between the database and web server (Internet Information Server 4.0) is provided by Cold Fusion, a web-database middle-ware product that uses ODBC to access the database. Server-side processing for database queries and data formatting is accomplished with Cold Fusion mark-up tags (extensions to HTML that implement database access functionality). A Visual Basic program using ESRI's MapObjects extension to dynamically generate maps provides GIS map output. The data to be displayed are passed to the Visual Basic program in an SQL Server temporary table. As shown in Figure 7, MapObjects returns a GIF image with counties shaded based on the data value for each county.

Users access the HDF website through the Internet from a web browser. Netscape Navigator 3.0 (and higher) and Microsoft Internet Explorer 4.0 (and higher) are supported. The majority of the user interface is written in HTML. Selected functions make use of Java or JavaScript. Java applets included with Cold Fusion are used to display data in chart format (bar chart or pie chart). JavaScript is used when counties are selected with an HTML client-side image map (as shown in Figure 3). The graphic image for the map and the HTML image map code are generated by an Arcview utility program, so that the image maps make use of county-level shape files.

Implications for Wildlife Management

A fundamental component of human dimensions is the provision of information from multiple social science perspectives (Ditton, 1996); indeed, wildlife management is "10 percent biology and 90 percent managing people" (Manfredo et al., 1996). The HDF and website provide a unique approach, and at least some empirical information, from which wildlife managers can draw and which they can use to understand the people side of their profession. Although information concerning people's attitudes, values, and perceptions regarding wildlife issues (Dimension 5) and evidence of power and special interest group involvement in wildlife decision-making (Dimension 4) is lacking in the website, the HDF does describe methods (both quantitative and qualitative) wildlife planners can use to collect primary data, as well as sources of secondary information. The identification and description of specific research methods is critical for many wildlife planners who have either not been trained or are unfamiliar with social science data.

Limitations

Before drawing conclusions for wildlife management, several limitations to the HDF website should be recognized. First, data from the site provide input for decision making, using a conceptual approach; the website is not a decision tool and should not be confused with previous efforts directed at solving natural resource concerns such as the spotted owl controversy (FEMAT, 1993) and wildlife–human conflicts in the Interior Columbia River Basin (USDA Forest Service and UDSI Bureau of Land Management, 1996). Second, the HDF website is biased predominantly to supply-side data (e.g., state wildlife acres) and does not provide good coverage of demand data, such as hunting and fishing participation. Although demand data are often not available at the county scale, the HDF website should be upgraded to include at least regional, and preferably state-wide, estimates of participation and harvesting rates, for example. Third, the data are limited to one variable at the county level for one (selected) national forest in one geographic region of the country (i.e., multiple variables cannot be selected). Fourth, the HDF website is not intended to be a "how-to guide" for social science applications in natural resource management. Rather, the website provides limited information useful for forest planning and assessments. It is intended for use by anyone interested in gathering information (data and methods of data collection) concerning the human dimensions of forest planning. Fifth, the number of variables available in the SEELA database is limited primarily to information on two dimensions: population characteristics and community resources. For the remaining three dimensions (historical background, social organization structure and processes, and public perceptions and well-being) in the HDF, the website describes the appropriate methods for collecting data. Similarly, data pertaining to some of the assessment questions are not accessible via SEELA.

Conclusions

Several research needs for human dimensions information in wildlife exist and may be grouped into at least two classifications: wildlife-specific and wildlife-related. Wildlife-specific information concerns the direct use of wildlife such as subsistence uses, social value of T&E species, wildlife-dependent recreation uses, and economic values of wildlife. Wildlife-related information includes implications and the effects associated with the indirect use of wildlife, such as changes in land use, human use patterns, human demographics, shifts in public values toward the environment, and changes in local economies. Clearly, the SEELA database in the current HDF website contains a much stronger focus on wildlife-related than

wildlife-specific information. Human dimensions wildlife-specific data at the county level or finer (e.g., community, census block group, etc.) for the nation are not only difficult to locate but also temporally dependent. Information spanning different time periods is a critical dimension, given increasing and dynamic changes in public support and awareness of wildlife (e.g., Manfredo et al., 1996, Tarrant, Bright, & Cordell, 1997;).

Given that wildlife professionals must manage natural and wildlife resources in the public interest, the HDF website provides population data of demographic, economic, social, and other (e.g., land-use) trends (at county level) for the entire nation. As such, information concerning many more citizens (than through sampling techniques alone) can be included in the decision-making process. For example, while surveys and public meetings provide very specific and timely, but costly, information on current wildlife issues and agendas, information on national human migration patterns, local economies related to wildlife (e.g., timber, recreation, etc.), and land tenure can sometimes only be gained through population estimates such as census data.

In addition to expanding SEELA to include wildlife-specific information, an important future advancement of the HDF website is to demonstrate the explicit application of human dimensions data to wildlife needs and issues. Such training and application can be provided via a distance education web-based environment using electronic performance support systems (EPSS). An EPSS is an electronic system that provides integrated, on-demand access to information, advice, learning experiences, and tools to enable a high level of job performance with a minimum of support from other people (Gery, 1991). Within the past few years, EPSS has become a hot topic for organizational development, human resources, performance technology, and training development for professionals. It is sometimes referred to as "just-in-time" training (Geber, 1991) and enables novice users to be productive on the very first day they start using a system (Gery, 1995).

A future step in the HDF website is the development of an EPSS for training wildlife and forestry professionals in the application of HD information. Such an application likely would be organized into "granules" (i.e., modules), usually 5–15 minutes of instruction, which deal with specific topics (e.g., environmental justice, reintroduction of extirpated native species, etc.) that can be accessed while tasks are being performed. For example, in response to President Clinton's Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," Federal Register, 1994), all public land management agencies are under mandate to assess the environmental justice implications of their policies, practices, and programs. Tarrant and Porter (in press) recently used census data to examine the spatial distribution of

contaminated fisheries (fish advisory areas) in proximity to community residents' economic and social demographic status. By applying a GIS-based approach, findings showed that communities comprised of more nonwhites were significantly more likely to live closer to fish advisory areas than were communities comprised of more whites. A wildlife management EPSS could support just-in-time training to provide both data and methods needs for considering environmental justice practices of wildlife managers across the country.

Clearly, a critical component of this just-in-time learning is the creation of explicit scenarios of how human dimensions information has been used to solve previous problems and how that approach can be adapted to address current and future issues. Aside from the development of scenarios, other major costs of an EPSS-wildlife management system include software development, software evaluation, and technical support.

References

Branch, K., Hooper, D. A., Thompson, J., & Creighton, J. (1984). *Guide to social assessment: A framework for assessing social change.* Boulder, CO: Westview Press.

Bright, A. D., Cordell, J. K., Tarrant, M. A., & Hoover, A. (in press). *A human dimensions framework for forest planning and assessments.* USDA Forest Service General Technical Report, Southern Forest Experiment Station, Athens, GA: USDA Forest Service.

Ditton, R. B. (1996). Human dimensions in fisheries. In A.W. Ewert (Ed.), *Natural Resource Management: The human dimension* (pp. 73-90). Boulder, CO: Westview Press.

Driver, B. L., Manning, C. J., & Peterson, G. L. (1996). Toward better integration of the social and biophysical components of ecosystems management. In A.W. Ewert (Ed.), *Natural Resource Management: The Human Dimension* (pp. 109-128). Boulder, CO: Westview Press.

Ewert, A. W. (Ed.) (1996). *Natural Resource Management: The Human Dimension.* Boulder, CO: Westview Press.

Exec. Order No.12898, 59 c. F.R. 7729 (1994, February 11). Washington, DC: US Government Printing Office.

Force, J. E., & Machlis, G. E. (1997). The human ecosystem part II: Social indicators in ecosystem management. *Society and Natural Resources, 10,* 369–382.

Forest Ecosystem Management Team (FEMAT) (1993). *Forest Ecosystem Management: An ecological, economic, and social assessment.* Joint publication of the USDA Forest Service, USDC National Oceanic and Atmospheric Administration and National Marine Fisheries Service, USDI Bureau of Land Management, Fish and Wildlife Service, and National Park Service, and U.S. EPA, Washington, DC: Author.

Geber, B. (1991). Help! The rise of performance support systems. *Training, 28*(12), 23–29.

Gery, G. (1991). *Electronic performance support systems: How and why to remake the workplace through the strategic application of technology.* Boston Weingarten.

Gery, G. (1995). Attributes and behavior of performance-centered systems. *Performance Improvement Quarterly, 8*(1), 47–93.

Machlis, G. E., Force, J. E., & Burch, W. R. (1997). The human ecosystem part I: The human ecosystem as an organizing concept in ecosystem management. *Society and Natural Resources, 10,* 347–367.

Manfredo, M. J., Vaske, J. J., & Sikorowski, L. (1996). Human dimensions of wildlife management. In A. W. Ewert (Ed.), *Natural resource management: The human dimension* (pp. 53–72). Boulder, CO: Westview Press.

Manley, P. N., Brogan, G. E., Cook, C., Flores, M. E., Fullmer, D. G., Husari, S., Jimerson, T. M., Lux, L. M., McCain, M. E., Rose, J. A., Schmitt, G., Schuyler, J. C., & Skinner, M.J. (1995). *Sustaining Ecosystems: A conceptual framework version 1.0.* USDA Forest Service Pacific Southwest Station, WA.

Myers, D. (1992). *Analysis with local census data: Portraits of change.* San Diego, CA: Academic Press.

Schlager, D. B. & Freimund, W. A. (1997). Legal and institutional obstacles to implementing ecosystem management. In H. K. Cordell (Ed.), *Integrating social science and ecosystem management: A national challenge.* (GTR SRS-17). Athens, GA.USDA Forest Service Southern Research Station.

Stewart, S. I., Jakes, P. J., & Monson, P. (1997). Emergent issues in forest plan revision: A dialogue. In H. Vogelsong (Ed.), *Paper presented at the Northeast Recreation Research Symposium,* NY.

Tarrant, M. A., Bright, A. D., & Cordell, H. K. (1997). Attitudes toward wildlife species protection: Assessing moderating and mediating effects in the value-attitude relationship. *Human Dimensions of Wildlife, 2*(2), 1–20.

Tarrant, M. A. & Porter, R. (in press). Environmental justice and the spatial distribution of fish advisory areas in the Southern Appalachians: A geographic information systems approach. *Human Dimensions of Wildlife.*

USDC Bureau of the Census. (1996). *USA Counties 1996 Census CD-ROM.* Washington, DC. USDC Bureau of the Census.

USDA Forest Service. (1997). *National outdoor recreation supply information system.* Athens, GA. USDA Forest Service Southern Research Station.

USDA Forest Service. (1996). *Social geographic information system.* Fort Collins, CO. USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

USDA Forest Service National Task Force on the Human Dimensions of Ecosystem Management (1994). *The human dimension in sustainable ecosystem management: A management philosophy.* Albequerque, NM. USDA Forest Service Southwest Region.

USDA Forest Service and USDA Bureau of Land Management. (1996). *Status of the Interior River Columbia Basin: A summary of scientific findings.* (GTR PNW-385). WA. USDA Forest Service Pacific Northwest Research Station.

Woods & Poole Economics, Inc. (1997). *The complete economic and demographic data source.* Washington, DC: Author.